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ABSTRACT

Pennsylvania State University conducts a program of preservice performance-based teacher education (PBTE) for its agricultural education students at several campuses in the state. The model for the program is designed around groups of pedagogical competencies identified and verified through research. The competencies have been incorporated into the course structure of the agricultural education program, with each course including a number of related competencies to be achieved. The program is delivered in two phases: course work and student teaching. Teacher educators serve as resource persons. Modules from the National Center for Research in Vocational Education and some additional modules unique to agricultural education and Pennsylvania's needs are used to develop competence in performing those tasks identified as necessary for entry-level employment as a teacher of vocational agriculture. Instructional emphasis is on helping the preservice student and teaching intern achieve program exit requirements. Teaching students are gradually introduced to the classroom through a process of teaching to peers, microteaching experiences, program observations, conducting Future Farmers of America activities, and presenting teaching episodes under guidance, before they begin teaching one or two classes in the intern program. Students are assessed by resource persons using checklists provided in the modules and other instruments, and students are expected to remain in the program until all requirements are met. (A list of competencies in the programs, learning activities used, and a summary of the teacher's and students' roles are included in this report.) (KC)

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PBTE Program

Department of Agricultural and Extension Education

The Pennsylvania State University

James H. Mortensen
Associate Professor of Agricultural Education

A paper presented at
National Conference on Performance-Based
Teacher Education, Competency-Based Staff Development,
and Competency-Based Administrator Education

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PBTE Program

Department of Agricultural and Extension Education

Overview

The Department of Agricultural and Extension Education administers a preservice program approved by the Pennsylvania Department of Education for the preparation of agriculture teachers in public school systems. This includes programs in agricultural production, mechanics, supplies, resources, products, forestry, ornamental horticulture, and other agricultural areas. The agricultural education program serves the agriculture teacher education needs of the entire Commonwealth, which includes rapidly expanding urban areas as well as several sparsely populated rural counties.

Students studying to become teachers of agriculture take courses in four areas of technical agriculture (animal science, plant science, business and agricultural engineering). They schedule professional courses in education and psychology, as well as courses in natural science, social science, quantification, and communication. Approximately 78 percent (160) of those in the program are preservice students pursuing a baccalaureate or graduate degree in agriculture. Some 22 percent (47) are teachers on-the-job, recruited directly from business, industry, and colleges of agriculture for the teaching profession. At the present time, all inservice teacher interns hold a baccalaureate degree. They come to Penn State for their initial Instructional I certification program and for graduate degrees. Because of the extensive geographic area to be covered, instruction is delivered on the University Park Campus, selected Commonwealth Campuses (there are 17), 15 outreach inservice centers, and 50 cooperating public school vocational agriculture programs.

The PBTE program is being maintained through each of the following functions: selection and organization of program content, selection and organization of (learning) experiences, management of learners and learning environment, and the assessment of learning. There are a number of important components in the PBTE program including: students, resource persons (field-based and university-based), modules of instruction, learning resource center, group instruction, individual instruction and other hardware and software. The focus of this paper is how the program functions are fulfilled utilizing the components available.

Program Content

The model for vocational agriculture teacher education is designed around groups of pedagogical competencies* identified and verified through research. The competencies have been incorporated into the course structure of the agricultural education program. Each course includes a number of related competencies to be achieved.

The program is delivered in two phases: (1) the preservice student and teaching intern achieve proficiency in all program competencies through the cognitive and simulated application level within the university setting, and (2) the preservice student and teaching intern demonstrate competence in actual school situations while student teaching.

Teacher educators serve as resource persons. They are assisted by graduate students and inservice teachers. Cooperating teachers serve

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*Marvin G. Hawk. "Pedagogical Competency Needs of Beginning Teachers of Agriculture in Pennsylvania." M.Ed. Thesis, The Pennsylvania State University Library, 1977.

Bruce L. Witmer. "Professional Education Competencies Needed by Beginning Teachers of Agriculture/Agribusiness in Education in Pennsylvania." D.Ed. Thesis, The Pennsylvania State University Library, 1979.

as resource persons during student teaching as well as the early field-based experience. Teacher educators have been inserviced on PBTE at regional and national workshops conducted by the National Center for Vocational Education. Cooperating teachers are inserviced annually at a two-day summer workshop.

Learning Experiences

Instruction is provided to develop competence in performing those tasks identified as necessary for entry level employment as a teacher of vocational agriculture. Modules from the National Center for Research in Vocational Education and some additional modules unique to agricultural education and Pennsylvania's needs are utilized. The program includes individualized instruction and counseling, class sessions devoted to each competency, and small group simulated classroom or laboratory situations.

Instructional emphasis is on helping the preservice student and teaching intern achieve program exit requirements. Progress is dependent on the demonstration of competence. Each student teacher is expected to demonstrate the attainment of each competency in an actual school setting.

Small group activities are the heart of the university-based instruction. Instruction in groups of 15-30 students permits interaction, enrichment and practice thus making the competency meaningful and the units/modules come alive. The dialogue and interchange permitted in small classes is an essential component of this program.

Group instruction is spent on varied activities such as group discussion, student presentations, small group work, microteaching, practice and problem solving. Very little time is used for lectures or formal

presentations by the resource person. Module learning activities are done by students outside of the group meeting, but the activities serve as a basis for group discussion.

Videotapes of the student's performance provides excellent feedback to the learner and to the resource person in assisting the learner to evaluate and improve performance. The Department of Agricultural and Extension Education has two videotape cameras for use in the professional development of teachers. Learning activities to develop competence in "Introducing a Lesson," "Summarizing a Lesson," and "Employ Oral Questioning Techniques" require the videotaping of student performance.

Management of Learners

During winter term of the junior year, preservice students select and are assigned to their cooperating teacher in a public school vocational agriculture program. During the spring (sometimes summer) and fall terms preservice students progress through instructional planning, delivery, and evaluation of instruction with a sequencing process of teaching to peers, microteaching experiences, vocational agriculture program visits and observations, conducting local, regional and state FFA activities, and presenting teaching episodes under their field-based resource person.

Due to the frequent contact with their field-based resource person, when preservice teachers begin their student teaching experience in December or March, they can start right in by teaching one or two classes. The transition to student teaching is established between the student teacher and the field-based resource person and between the student teacher and students. The field-based resource person, along with the

university resource person, continue the evaluation of teaching competencies during the student teaching experience.

A "Student Teacher Notebook" is prepared each term and provided to the student teacher and field-based resource person. An orientation session is held so student teachers are cognizant of their roles and the roles of their resource persons.

Assessment

Performance assessment takes place in the university setting and in actual school situations. As preservice students and teaching interns work to achieve a competency within the university setting, they deliver a specified performance or produce a specified product appropriate to the competency. The results are assessed by the university-based resource person using assessment criteria made known to the preservice student and teaching intern. Assessment instruments contained in the vocational teacher education modules from the National Center for Research in Vocational Education and some additional assessment instruments prepared by the Penn State faculty are utilized. The performance or product must reach criterion, otherwise the preservice student and teaching intern are recycled until an acceptable level is achieved.

As students enter the program, they come with a variety of backgrounds, abilities, and previously developed skills. It is conceivable that a preservice or inservice teacher may already possess the skills necessary to successfully demonstrate some of the competencies in the PBTE program. For this reason, provision has been made for students to "challenge" competencies in the program. Challenging is accomplished by providing copies or documentation of product or plan developments, and by

demonstrating teaching skills prior to group discussion sessions. Some students have challenged competencies involving the advising of FFA chapters and skill performances on audio visual equipment.

Regardless of whether a student challenges competencies or attends group meetings and attempts competencies at his/her own pace, assessment is accomplished using checklists from appropriate learning experiences in the instructional modules, Teacher Performance Assessment Forms (TPAF's) from the modules, or special checklists developed at Penn State. The checklists are used to determine whether or not a student has completed all necessary steps in a performance or addressed all necessary topics in a written product. Modules used in the program have learning experiences appropriate for university-based assessment, and final experiences equally as appropriate for final assessment in an actual classroom situation.

While student teaching, the preservice student and teaching intern demonstrate the competency in an actual school situation. Assessment of the performance is made by university and field-based resource persons. To ensure assessment forms are used appropriately, objectively, and consistently, field-based resource persons are inserviced in the use of assessment instruments at their Cooperating Teachers Workshop.

As previously stated, each competency includes criteria for assessing learners' ability to perform. When students can perform as specified by the criteria and standards, they are considered competent. This assessment is first made by the learner through self evaluation and then confirmed by a resource person. Teacher Performance Assessment Forms are utilized.

The following pages identify the professional roles of a teacher of vocational agriculture, the competencies within each role, and the learning activities in which these competencies are developed. The multi-colored section identifies agriculture subject matter competencies. Individually, preservice students in consultation with their advisor assess their level of agricultural competence and agriculture related work experience and develop a training plan for obtaining the agricultural competence and work experience needed for certification.

Vocational Agriculture Teacher's Role	Competencies	Learning Activities
1. Surveyor and translator of individual, community and occupational needs	Plan a community survey	Ag Ed 13v, 418v
	Conduct and analyze community survey data	Ag Ed 13v, 418v
	Report and use the findings of a community survey	Ag Ed 13v, 418v
	Organize or reorganize an occupational advisory committee	VocEd 1v
	Maintain an occupational advisory committee	VocEd 1v; Ag Ed 495v
	Develop VocEd programs, goals and objectives	Ag Ed 13v, 495v
	Determine needs and interests of students	Ag Ed 12v, 495v
	Develop long-range plans for a vocational agriculture program	Ag Ed 13v, 495v
2. Manager of instruction for high school vocational agriculture students and adults	Develop student performance objectives	Ag Ed 13v, 495v
	Plan a unit of instruction	Ag Ed 12v, 13v, 22v, 495v
	Write a lesson plan	Ag Ed 12v, 13v, 495v
	Select and obtain student instructional materials	Ag Ed 12v, 13v, 22v, 495v
	Prepare teacher-made instructional materials	Ag Ed 12v, 22v, 495v
	Direct individual and group field trips	Ag Ed 12v, 495v
	Conduct group discussions, panel discussions and symposiums	Collegiate FFA; Ag Ed 12v, 495v

Vocational Agriculture Teacher's Role	Competencies	Learning Activities
	Stimulate learning through brainstorming, buzz group and question box techniques	Collegiate FFA; Ag Ed 12v, 495v
	Direct students in instructing other students	Ag Ed 22v, 495v
	Develop a course of study	Ag Ed 12v, 13v, 22v, 495v
	Assist students in developing self-discipline	Collegiate FFA; Ag Ed 12v, 22v, 495v
	Present information with films	Ag Ed 12v, 495v
	Present information with the chalkboard	Ag Ed 12v, 495v
	Direct student study	Ag Ed 12v, 495v
	Direct student laboratory experience	Ag Ed 22v, 495v
	Direct students in applying problem-solving techniques	Ag Ed 12v, 22v, 495v
	Direct the project method	Ag Ed 22v, 495v
	Introduce a lesson	Ag Ed 12v, 22v, 495v
	Summarize a lesson	Ag Ed 12v, 22v, 495v
	Employ oral questioning techniques	Ag Ed 12v, 495v
	Employ reinforcement techniques	Ag Ed 12v, 495v
	Provide instruction for slower and more capable students	Ag Ed 12v, 495v
	Present information through an illustrated talk	Collegiate FFA; Ag Ed 12v, 22v, 495v

Vocational Agriculture Teacher's Role	Competencies	Learning Activities
	Demonstrate a manipulative skill	Ag Ed 22v, 495v
	Demonstrate a concept or principle	Ag Ed 495v
	Direct individualized instruction	Ag Ed 12v, 22v, 295v, 495v
	Present information using a subject matter expert	Ag Ed 12v, 22v, 495v
	Illustrate with models and real objects	Ag Ed 12v, 22v, 495v
	Present information with overhead and opaque materials	Ag Ed 12v, 495v
	Present information with filmstrips and slides	Ag Ed 12v, 22v, 495v
3. Supervisor of the occupational work experience programs of high school agricultural education students and adults who receive instruction	Identify, select and prepare students for appropriately selected agricultural production projects and/or agribusiness training stations	Ag Ed 13v, 495v
	Conduct home visits	Ag Ed 13v, 295v, 495v
	Confer with the students and parents regarding educational and occupational development skills	Ag Ed 13v, 495v
	Present information to students on occupational opportunities	Ag Ed 13v, 295v, 495v
	Communicate with prospective and continuing students during the summer	Ag Ed 13v, 495v

Vocational Agriculture Teacher's Role	Competencies	Learning Activities
4. Advisor of the FFA Chapter	Organize a local FFA Chapter	Collegiate FFA; Ag Ed 495v, 497v
	Orient vocational agriculture students to the fundamentals and principles of the FFA	Collegiate FFA; Ag Ed 495v, 497v
	Supervise the development, publication and implementation of an FFA program of activities	Collegiate FFA; Ag Ed 495v, 497v
	Supervise the election and preparation of local FFA officers	Collegiate FFA; Ag Ed 495v, 497v
	Prepare vocational agriculture students for participation in local, regional, state and national FFA activities	Collegiate FFA; Ag Ed 495v, 497v
	Assist students in advancing within the FFA degrees	Collegiate FFA; Ag Ed 495v, 497v
	Supervise the operation of an FFA public relations program	Collegiate FFA; Ag Ed 495v, 497v
	Supervise the financial operation and fund-raising activities of the chapter	Collegiate FFA; Ag Ed 495v, 497v
	Assist students in developing and conducting an appropriate award and recognition program	Collegiate FFA; Ag Ed 495v, 497v
	Supervise an annual evaluation of the FFA chapter	Collegiate FFA; Ag Ed 495v, 497v

Vocational Agriculture Teacher's Role	Competencies	Learning Activities
5. Advisor in the selection, placement and follow-up of students	Provide information on educational and career opportunities	Collegiate FFA; Ag Ed 12v, 495v
	Assist students in applying for employment or further education	Ag Ed 12v, 495v
6. Manager of instructional facilities	Organize the vocational laboratory	Ag Ed 22v, 295v, 495v
	Manage and maintain the vocational laboratory	Ag Ed 22v, 295v, 495v
	Maintain a filing system	Ag Ed 12v, 495v
	Provide for the safety needs of vocational students	Ag Ed 22v, 495v
7. Evaluator of students and programs	Establish criteria for student performance in a vocational education program	Ag Ed 13v, 495v
	Assess student cognitive performance	Ag Ed 12v, 495v
	Assess student psychomotor performance	Ag Ed 22v, 495v
	Determine student grades in a vocational program	Ag Ed 12v, 495v
	Evaluate instructional effectiveness	Ag Ed 12v, 22v, 295v, 495v
8. Administrator, supervisor and coordinator of the vocational agriculture department activities	Project instructional resource needs	Ag Ed 22v, 495v
	Organize a local YFA Chapter	Ag Ed 495v, 497v
	Identify the responsibilities of the vocational agriculture teacher in the operation of a YFA chapter	Ag Ed 495v, 497v

Vocational Agriculture Teacher's Role	Competencies	Learning Activities
	Identify key elements in successfully operating YFA chapters	Ag Ed 495v, 497v
9. Facilitator of co-coperation between school, parents, employers, business and community	Provide service to maintain liaison with members of the community	Ag Ed 12v, 295v, 495v
10. Participator in professional growth and development activities	Keep up to date in your profession and in your occupation specialty	VocEd 1v; Ag Ed 495v
	Serve your teaching profession	Collegiate FFA; VocEd 1v; Ag Ed 495v
	Establish and maintain a professional philosophy of education	VocEd 1v; Ag Ed 495v
	Select, obtain, and maintain a teaching position in keeping with your professional qualifications	Ag Ed 495v

TRAINING PLAN--AGRICULTURAL WORK EXPERIENCE
The Pennsylvania State University
Department of Agricultural Education

Student's Name _____ Advisor _____ Date _____

Competency Area	Add. Exp. Needed: Required Before Cert.	Add. Exp. Needed: Suggested Before Cert.
BASIC AG MECHANICS		
I. Safety--Gen. Mech.		
II. Metal/Plumbing		
III. Welding		
IV. Power & Machinery		
V. Concrete/Masonry		
VI. Carpentry/Const.		
PRODUCTION AGRICULTURE		
I. Beef/Dairy		
II. Sheep		
III. Swine		
IV. Horse		
V. Agronomy		
VI. Poultry		
HORTICULTURE		
I. Landscape		
II. Greenhouse		
III. Floral Mdsg/Design		

Competency Area	Add. Exp. Needed: Required Before Cert.	Add. Exp. Needed: Suggested Before Cert.
AGRICULTURAL RESOURCES		
I. Fish		
II. Forestry		
III. Mine Land Restoration		
IV. Outdoor Recreation		
V. Wildlife		
VI. Soils		
AGRICULTURAL MACHINERY		
I. Selling Parts/Mdsg.		
II. Set-up/Delivery		
III. Service		

Suggested Type Work Site: _____

_____

Duration: _____

_____

STATEMENT OF AGRICULTURAL WORK EXPERIENCE
The Pennsylvania State University, Department of Agricultural Education

Name _____ Permanent Address _____ Home Phone _____

High School/AVTS _____ City _____ HS Grad. Yr____ Yrs Vo-Ag ____ Yrs 4-H ____

Vo-Ag Teacher Name _____ Highest FFA Degree _____ 4-H Honors _____

Elected Offices Held _____ Current Term Standing ____

SOE Production Project(s) (incl. scope) _____

_____

_____

Directed Laboratory Experience(s) _____

_____

_____

WORK EXPERIENCE (list most recent job first)

Employment Dates		Employer				Type of work performed (e.g., milking, cropping, greenhouse)	Your job Title
Beginning Mo/Yr	Ending Mo/Yr	Business Name	Business Address	Business Phone	Name of Supervisor		

23

Your Area(s) of Teaching Interest:

- ☐ production agr.
- ☐ agr. business/ supplies/services
- ☐ agr. mechanics/ machinery
- ☐ Horticulture
- ☐ agr. products (food processing)
- ☐ renewable natural resources
- ☐ forestry
- ☐ cooperative ext

The information given is an accurate statement of my agricultural experience. (signed) _____ (date) _____ 24

Dept. recommendations for additional experience _____

_____

_____

Advisor's Intls_____ Date_____ ☐ See training plan on back

Department of Agricultural Education
The Pennsylvania State University

BASIC AGRICULTURAL MECHANICS SKILLS INVENTORY

Instructions to the student: Rate yourself on each of the "hands-on" skills listed below. These competencies have been identified as necessary to effectively teach many vocational agriculture programs. When completed, make an appointment with your advisor to discuss this inventory and to obtain his recommendation for further experience if needed.

Instructions to the advisor: Discuss this inventory with the student when it has been completed. Recommend additional experience if it is needed.

Note: This inventory is used for the purposes of advisement only. It does not become part of the student's Career Placement File and cannot be used by the student or advisor for job placement.

	Can Perform	Cannot Perform
I. Competencies needed in Safety and General Mechanics		
1. Develop safe and efficient shop layout.		
2. Maintain safety instruction record file		
3. Select, maintain, and provide personal safety equipment		
4. Identify, select and maintain proper fire fighting and fire prevention equipment.		
5. Select and order hand tools		
6. Identify, (inventory, and store hand tools)		
7. Plan tool storage and arrangement.		
8. Use, adjust, sharpen and maintain hand wood and metal working tools		
9. Select and order power tools		
10. Use correctly, operate safely, and maintain the following power tools:		
A. Portable electric saw		
B. Radial arm saw		
C. Tilting arbor saw		
D. Drill press		
E. Portable electric drill		
F. Grinder - bench and pedestal		
G. Portable grinder		
H. Sabre saw		
I. Band saw - metal and wood cutting		
J. Jointer		
K. Surface planer		
L. Sander - belt, disc and vibrator		
M. Metal lathe		
N. Wood lathe		
O. Steam cleaner		
P. High pressure washer		
Q. Paint sprayer		
R. Welders - electric and gas		
S. Chain saw		
T. Parts washer		
U. Any other specialized tool found in the shop.		

	Can Perform	Cannot Perform
11. Operate and maintain air compressor.		
12. Identify, select and use common hardware and finishing materials		
13. Prepare a bill of materials.		
14. Select and use drawing pencils, measuring devices, scales, etc.		
15. Prepare sketches and simple drawings.		
II. Hot and Cold Metal, Plumbing, Sheet Metal		
1. Safely operate and maintain a forage.		
2. Select, properly and safely use and maintain the hand and power tools commonly used in metal working and plumbing.		
3. Bend, cut, file, drill, rivet and square cold metal.		
4. Ream and countersink holes.		
5. Layout, shape, bend and cut hot metal.		
6. Read a micrometer.		
7. Temper metal.		
8. Cut and tap threads.		
9. Extract broken bolts.		
10. Select a heat source for soldering and solder small holes, seams, and sweat on a patch.		
11. Identify parts, select, lay-out, cut, thread, ream and connect galvanized or black iron pipe.		
12. Select copper tubing and parts, cut, flare and assemble copper tubing.		
13. Identify, cut, and assemble plastic pipe.		
14. Select and maintain water pumps and valves.		
15. Determine carrying capacities of water pipes.		
16. Determine volume capacities of water systems.		
III. Electric Arc, Oxy-acetylene, TIG, MIG, Welding		
1. Select arc welding machines, equipment and electrodes.		
2. Safely operate and maintain arc welders and equipment.		
3. Safely set up, operate, and adjust a carbon arc torch.		
4. Correctly identify metals.		
5. Strike an arc and run a bead.		

	Can Perform	Cannot Perform
6. Make a bull weld - all positions.		
7. Make a lap weld - all positions.		
8. Make a fillet weld - all positions.		
9. Make a corner weld - all positions.		
10. Weld cast iron - (back step method).		
11. Cut and pierce with the arc welder.		
12. Braze with the carbon arc.		
13. Hard surface with the arc welder.		
14. Connect the welder for battery charging.		
15. Connect the welder for thawing pipes.		
16. Connect the welder for soldering.		
17. Interpret welding symbols.		
18. Cut with air-arc attachment.		
19. Select oxy-acetylene welding and cutting equipment.		
20. Safely assemble, operate, and maintain oxy-acetylene equipment.		
21. Select proper flux, rods, and tips for gas welding.		
22. Braze, weld, and cut metal with oxy-acetylene equipment.		
23. Select and apply hard surfacing materials.		
24. Apply silver solder.		
25. Select, operate and maintain a TIG and MIG welding machine.		
26. Weld aluminum, mild steel, stainless steel and aluminum alloys with TIG equipment.		
27. Select rods for TIG equipment.		
28. Operate and push and pull type MIG.		
29. Select wire for the job with MIG welding.		
IV. Power and Machinery		
1. Understand the principles of the two and four stroke cycle engines.		
2. Identify type, size, and make of small engines.		
3. Lubricate, service and maintain small engines.		
4. Trouble-shoot small engines.		
5. Repair and overhaul small engines.		
6. Operate and maintain a small engine dynamometer.		

	Can Perform	Cannot Perform
7. Identify tractor type, size and make.		
8. Lubricate and service tractors.		
9. Maintain and repair tractor.		
10. Overhaul tractor engine.		
11. Use and maintain an engine overhaul stand.		
12. Operate and maintain engine overhaul and repair equipment (valve grinder, valve seat grinders, ridge reamers, sleeve pullers, cylinder, gauge hones, deglazers, etc.).		
13. Use a battery charger and a hydrometer.		
14. Operate engine part testing equipment. (timing light, coil and condenser tester, spark plug tester, compression gauge, techometers, etc.).		
15. Install and adjust coil, condenser, points, spark plug, voltage regulator, etc.		
16. Use and maintain parts washer, steam and high pressure cleaners.		
17. Operate engine performance testing equipment (exhaust analyzer, alternator-generator tester, oscilliscope, fuel pump tester, vacuum gauge, nozzle testers, tach-dwell meter, etc.		
18. Safely operate tractors.		
19. Understand principles of hitching.		
20. Understand principles of hydraulics.		
21. Select, use, and maintain hydraulic regulators, lines, pumps, valves, actuators, and reservoirs.		
22. Operate hydraulic test equipment.		
23. Select, operate, adjust, and maintain tillage equipment (plows, disks, harrows, and cultipackers).		
24. Select, operate, adjust, and maintain planters and grain drills.		
25. Select, operate, adjust and maintain cultivators, and rotary hoes.		
26. Select, operate, adjust, and maintain harvesting equipment (field harvestors, balers, corn pickers, combines, etc.).		
27. Select, operate, adjust and maintain storage equipment (silo blowers, unloaders, self-unloading wagon, augers, conveyors, elevators, etc.).		
28. Select, operate, adjust, and maintain drying equipment.		

	Can Perform	Cannot Perform
29. Select, operate, adjust, and maintain feed preparation equipment (hammer and roller mills, grinder blenders, etc.).		
30. Select, operate, adjust, and maintain manure and fertilizer handling and spreading equipment.		
31. Select, operate, adjust, and maintain field and orchard sprayers.		
32. Select, operate, adjust, and maintain composters, and shredders.		
33. Select, operate, adjust, and maintain rototillers.		
34. Select, operate, adjust, and maintain turf equipment (mowers, thatchers, aerators, edgers, weeders, etc.)		
35. Select and maintain milking machines, milk handling and milk cooling equipment.		
36. Use parts manuals and parts ordering procedures.		
37. Maintain a repair and servicing record filing system		
38. Maintain agricultural power equipment and machinery library.		
39. Identify, operate, select, and maintain power transfer devices for agriculture power machinery.		
V. Concrete and Masonry		
1. Practice safety at all times.		
2. Properly locate, plan for proper drainage, layout, and determine elevation for a building foundation.		
A. Determine location		
B. Explain proper drainage plan		
C. Layout - square a building		
D. Determine elevation		
3. Select, estimate quantity, calculate proportions and mix concrete.		
A. Select ingredients		
B. Calculate proportions		
C. Estimate quantity of ingredients		
D. Properly mix the concrete		
E. Water-cement ratio		

	Can Perform	Cannot Perform
4. Build forms, provide for expansion, and cast, reinforce, cure, and finish concrete.		
A. Build a form		
B. Make provisions for expansion joint		
C. Make provisions for reinforcement		
D. Cast concrete		
E. Cure concrete		
F. Finish concrete		
5. Identify masonry units and lay, reinforce, and parge concrete blocks, including selection and mixing mortar, and providing for expansion.		
A. Identify masonry units		
B. Select mortar mix		
C. Mix mortar		
D. Lay blocks		
E. Reinforce blocks		
F. Parge blocks		
G. Provide for expansion		
6. Calculate the materials necessary for a concrete block building, including the footers and floors.		
A. Number of units		
B. Concrete necessary for footers and floors		
7. Identify tools and materials used to concrete and masonry.		
A. Tool identification		
B. Masonry unit identification		
C. Ingredient identification		
VI. Competencies needed in Carpentry and Building Construction		
1. Identify frame building types, i.e. studding, pole, etc.		
2. Draw a frame building plan to scale.		
3. Read and interpret building plan symbols and drawings.		
4. Calculate a bill of materials from the plan.		
5. Identify, select and calculate costs of lumber.		
6. Use the framing square.		
A. Lay out and cut a common rafter.		

	Can Perform	Cannot Perform
B. Lay out and cut a stair stringer.		
C. Lay out and cut a brace		
D. Lay out a studded wall including an inside/outside corner, door and window openings.		
7. Identify parts of a stud type structure.		
8. Identify parts of a pole type structure.		
9. Identify, select and use plywood and other sheathing materials.		
10. Measure, mark, square, mitre and saw lumber.		
11. Identify and select roof types.		
12. Identify and select roofing materials.		
13. Choose a roof deck for each roofing material.		
14. Identify and select insulating materials.		
15. Identify and select windows and other materials that admit light.		
16. Identify and select from various ventilation systems.		
17. Identify, select and apply fasteners and hardware.		
18. Identify, select and apply paint and preservatives.		
19. Identify, select and install spouting.		
20. Replace window glass.		

Department of Agricultural Education
The Pennsylvania State University

PRODUCTION AGRICULTURE SKILLS INVENTORY

Instructions to the student: Rate yourself on each of the "hands-on" skills listed below. These competencies have been identified as necessary to effectively teach a production agriculture program. When completed, make an appointment with your advisor to discuss this inventory and to obtain his recommendation for further experience if needed. Also complete a BASIC AGRICULTURAL MECHANICS SKILLS INVENTORY.

Instructions to the advisor: Discuss this inventory with the student when it has been completed. Recommend additional experience if it is needed.

Note: This inventory is used for the purposes of advisement only. It does not beomce part of the student's Career Placement File and cannot be used by the student or advisor for job placement.

	Can Perform	Cannot Perform
I. Beef and Dairy Husbandry Skills:		
1. Detect cows in heat.		
2. Detect cows in labor.		
3. Assist in delivery of calves.		
4. Detect and treat internal and external parasites.		
5. Detect sick animals.		
6. Give medication with dose syringe and hypodermic needle.		
7. Mark cattle with eartags; brand cattle.		
8. Dehorn cattle.		
9. Castrate calves.		
10. Trim feet.		
11. Judge market and breeding cattle.		
12. Maintain breeding and production records.		
13. Identify major external and internal parts		
14. Estimate live cattle weight accurately.		
15. Feed balanced rations.		
16. Milk cows with machines.		
17. Fit and show beef cattle.		
18. Fit and show dairy cattle.		
19. Load and transport cattle.		
20. Successfully raise calves on milk-replacer.		
II. Sheep Husbandry Skills:		
1. Assist ewes at lambing.		
2. Detect and treat internal and external parasites.		
3. Recognize symptoms of common sheep diseases.		
4. Give medication and vaccines (e.g., drenching)		
5. Castrate and dock lambs.		
6. Catch and handle sheep - use of hands and crook.		
7. Judge market and breeding sheep.		
8. Determine age by teeth.		
9. Identify anatomical defects.		
10. Feed balanced rations.		
11. Fit and show sheep.		
12. Trim feet.		

	Can Perform	Cannot Perform
13. Shear sheep.		
14. Load and transport sheep.		
15. Identify major internal and external parts.		
16. Maintain breeding and production records.		
III. Swine Husbandry Skills:		
1. Detect sows in heat.		
2. Detect sows in labor.		
3. Assist in farrowing.		
4. Detect and treat internal and external parasites.		
5. Recognize symptoms of common swine diseases.		
6. Give medication and vaccines - (feed additives and pharmaceuticals).		
7. Clip needle teeth.		
8. Ear notch.		
9. Castrate.		
10. Dock tails.		
11. Judge market and breeding swine.		
12. Feed balanced rations.		
13. Handle breeding boars and lactating sows safely.		
14. Fit and show swine.		
15. Estimate weight of live swine accurately.		
16. Load and transport swine.		
17. Probe back fat.		
18. Identify major internal and external parts.		
19. Maintain breeding and production records.		
IV. Horse Husbandry Skills:		
1. Assist mares with foaling.		
2. Detect and treat internal and external parasites.		
3. Recognize symptoms of common equine diseases.		
4. Identify common feet and leg problems.		
5. Groom and saddle a horse.		
6. Ride a horse.		
7. Groom a horse/clean hooves.		

	Can Perform	Cannot Perform
8. Catch and lead a horse.		
9. Restrain a horse safely.		
10. Feed balanced rations.		
11. Fit and show properly.		
12. Determine age by teeth.		
13. Load and transport horses.		
14. Identify major internal and external body parts.		
15. Maintain breeding records.		
16. Identify gaits.		
V. Agronomy Skills:		
1. Take soil samples.		
2. Interpret soil analyses recommendations.		
3. Determine soil texture.		
4. Analyze soil profile.		
5. Determine correct soil moisture for tillage.		
6. Prepare proper seedbed using tillage equipment.		
7. Sow seed using properly calibrated drill.		
8. Measure to determine acreage.		
9. Recognize nutrient deficiency symptoms.		
10. Recognize common crop weeds.		
11. Recognize common crop pests and diseases.		
12. Calculate application rates of fertilizer, herbicide, and pesticides.		
13. Apply fertilizers, herbicides, and pesticides using spray and tillage equipment in safe manner.		
14. Determine timing of harvest.		
15. Operate harvesting equipment -- e.g., baler, forage harvester, combine, etc.		
16. Maintain and adjust harvesting equipment.		
17. Determine moisture content of grain.		
18. Load and unload grain and hay.		
19. Make silage.		
20. Operate and maintain tractors.		

		Can Perform	Cannot Perform
VI.	Poultry Skills:		
	1. Examine and select birds for breeders.		
	2. Cull non-layers by sight method.		
	3. Handle birds to judge productive qualities.		
	4. Manage the environment in a poultry house.		
	5. Calibrate and adjust a ventilation system.		
	6. Manage a flock of birds for several weeks.		
	7. Participate in, train or coach a poultry judging team.		
	8. Caponize cockerels at 14 to 21 days of age.		
	9. Perform surgical debeaking, blood testing, dubbing or de-toeing.		
	10. Kill and dress a meat bird as oven ready.		
	11. Calculate cost of producing a dozen eggs.		
	12. Calculate cost of producing a pound of poultry.		
	13. Keep records to establish a monthly profit and loss statement.		
	14. Formulate a poultry ration for nutritional requirements for least cost production.		

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HORTICULTURE SKILLS INVENTORY

Instructions to the student: Rate yourself on each of the "hands-on" skills listed below. These competencies have been identified as necessary to effectively teach a horticulture program. When completed, make an with your advisor to discuss this inventory and to obtain his recommendation for further experience if needed.

Instructions to the advisor: Discuss this inventory with the student when it has been completed. Recommend additional experience if it is needed.

Note: This inventory is used for the purposes of advisement only. It does not become part of the student's Career Placement File and cannot be used by the student or advisor for job placement.

	Can Perform	Cannot Perform
I. Landscape Horticulture		
1. Maintaining golf course greens.		
2. Maintaining golf course tees.		
3. Maintaining golf course fairways.		
4. Maintaining golf course rough.		
5. Maintaining non-golfing areas.		
6. Servicing golf course equipment.		
7. Preparing turfgrass seed bed.		
8. Establishing turfgrass by seed.		
9. Establishing turfgrass by sod.		
10. Controlling pests in the turfgrass areas.		
11. Fertilizing turfgrass areas.		
12. Mowing the turfgrass area.		
13. Watering the turfgrass area.		
14. Renovating turfgrass areas.		
15. Propagation of nursery stock by:		
A. Seeds		
B. Cuttings		
C. Grafting and budding		
D. Layering		
16. Planting liner stock.		
17. Growing liner stock.		
18. Marketing liner stock.		
A. Ball and burlap		
B. Bare root.		
19. Potting container stock.		
20. Growing container stock.		
21. Marketing container stock.		
22. Designing the landscape.		
23. Reading a landscape plan.		
24. Preparing the landscape for planting.		
25. Constructing the permanent features.		
26. Planting the landscape plant material.		
27. Controlling pests on landscape plants.		
28. Fertilizing landscape plant material.		

	Can Perform	Cannot Perform
29. Pruning landscape plant material.		
30. Buying and selling landscape materials and supplies.		
31. Displaying and maintaining garden center products.		
32. Maintaining and repairing large trees.		
II. Greenhouse Production		
1. Purchasing and receiving immature plants.		
2. Propagating greenhouse crops by:		
A. Seeds		
B. Cuttings		
C. Bulbs, tubers and corms		
D. Grafting and budding		
E. Layering and division		
3. Growing potted chrysanthemums.		
4. Growing poinsettias.		
5. Growing Easter lilies.		
6. Growing azaleas.		
7. Growing foliage plants.		
8. Growing spring bulbs.		
9. Growing African violets.		
10. Growing gloxinas.		
11. Growing hydrangeas.		
12. Growing cyclamen.		
13. Growing calcelarias and cinerias.		
14. Growing bedding plants.		
15. Growing geraniums.		
16. Growing hanging baskets.		
17. Growing carnations.		
18. Growing snap dragons.		
19. Growing cut chrysanthemums.		
20. Growing roses.		
21. Growing orchids.		
22. Growing greenhouse tomatoes.		
23. Grading and marketing greenhouse crops.		

	Can Perform	Cannot Perform
III. Floral Merchandising and Design		
1. Displaying and maintaining flower shop products.		
2. Buying and selling flower shop products.		
3. Constructing holiday and special occasion arrangements.		
4. Constructing corsages, nosegays and flowers to wear.		
5. Constructing dried arrangement.		
6. Constructing permanent arrangements.		
7. Delivering flower shop products.		
8. Providing wedding and funeral consultations.		
9. Constructing wedding designs.		
10. Constructing funeral designs.		
11. Using the wire services.		

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AGRICULTURAL RESOURCES SKILLS INVENTORY

Instructions to the student: Rate yourself on each of the "hands-on" skills listed below. These competencies have been identified as necessary to effectively teach an agricultural resources program. When completed, make an appointment with your advisor to discuss this inventory and to obtain his recommendation for further experience if needed.

Instructions to the advisor: Discuss this inventory with the student when it has been completed. Recommend additional experience if it is needed.

Note: This inventory is used for the purposes of advisement only. It does not become part of the student's Career Placement File and cannot be used by the student or advisor for job placement.

	Can Perform	Cannot Perform
I. Fish		
1. Managing fish in lakes, ponds and streams.		
A. Identify species of freshwater and saltwater fish.		
B. Make a chemical water analysis.		
C. Determine dissolved oxygen level.		
D. Test for water pH level.		
E. Identify water pollutants.		
F. Determine amount of pollutants present.		
G. Determine water temperature.		
H. Observe water turbidity.		
I. Measure water fertility.		
J. Identify algae and weed problems.		
K. Sein fish.		
L. Estimate fish populations.		
M. Use fish traps.		
N. Destroy fish nests to correct for imbalance.		
O. Use fish toxicants for population reduction.		
P. Establish and adjust harvest schedules.		
Q. Stock water impoundments and waterways.		
R. Determine fish stocking methods to use.		
S. Plant cover crops in watershed area.		
T. Plant trees and shrubs in watershed area.		
U. Identify cropping system in watershed area.		
V. Apply chemicals to control weeds and algae.		
W. Maintain chemical applying equipment.		
X. Fertilize water impoundments.		
Y. Operate boats.		
Z. Explain fishing and boating laws to the public.		
AA. Provide public relations.		
2. Managing fish in the hatchery.		
A. Identify various uses of hatchery fish (game, pan, bait and forage).		
B. Clean brood ponds.		
C. Aerate brood ponds.		

	Can Perform	Cannot Perform
D. Fertilize brood ponds.		
E. Drain brood ponds.		
F. Clean raceways and troughs.		
G. Service aerating and pumping equipment.		
H. Service feeding equipment.		
I. Identify and control fish parasites.		
J. Use materials to control fish parasites.		
K. Use materials to keep predators out of brood ponds.		
L. Feed brood and fry fish and fingerlings.		
M. Stock brood fish.		
N. Clip fingerlings.		
O. Tag fingerlings.		
P. Handle and transport fish.		
Q. Determine stocking rates.		
R. Spawn fish.		
S. Check O_2 level, pH, temperature, and hardness of water.		
II. Forestry		
1. Establishing Trees.		
A. Select varieties to use.		
B. Analyze planting site.		
C. Determine proper spacing.		
D. Determine planting rates.		
E. Prepare site for planting using chemical or mechanical methods.		
F. Transport tree seedlings.		
G. Store seedlings.		
H. Plant seedlings by machine or hand.		
I. Collect seeds.		
2. Improving timber stands.		
A. Weed timber stands using mechanical or chemical methods.		
B. Thin timber stands using selection system or row thinning.		

	Can Perform	Cannot Perform
C. Prune trees.		
D. Make pre-commercial and subsequent thinnings.		
E. Use increment borer to determine age of tree.		
3. Controlling timber diseases, insects and pests.		
A. Identify diseases, insects and pests.		
B. Mix chemicals.		
C. Apply chemicals.		
D. Maintain chemical application equipment.		
E. Use mechanical means to control diseases, insects and pests.		
3. Preventing and controlling fires.		
A. Build fire breaks.		
B. Maintain fire breaks.		
C. Locate fires.		
D. Build fire line.		
E. Fight fires by back firing or plowing out.		
4. Measuring Timber.		
A. Determine diameter breast height (DBH).		
B. Determine number of logs in tree.		
C. Use various tree volume tables.		
D. Identify tree defects.		
E. Interpret annual rings.		
F. Interpret maps and aerial photographs.		
G. Survey forest areas.		
H. Cruise timber.		
I. Make continuous forest inventory.		
J. Mark trees for harvesting.		
5. Producing Christmas Trees.		
A. Select site.		
B. Lay out plantation.		
C. Plant trees.		
D. Control competitive vegetation.		
E. Shear trees.		
F. Use colorant sprays.		

	Can Perform	Cannot Perform
G. Cut Christmas trees		
H. Grade and label trees.		
III. Mine Land Restoration		
1. Reclaiming mined areas.		
A. Analyze soil.		
B. Make water tests.		
C. Identify erosion problems.		
D. Interpret reclamation laws.		
E. Identify water and topographical features.		
F. Determine potential uses of mined land.		
G. Perform rough grading.		
H. Prepare seedbed for grasses.		
I. Plant trees.		
J. Sow grass or crops.		
K. Construct diversion ditches.		
L. Repair slide damage.		
M. Repair stream channels.		
IV. Outdoor Recreation		
1. Camping and picnic area activities.		
A. Maintain and repair camp water system.		
B. Maintain and repair camp sewage system.		
C. Maintain and repair camp buildings and structures.		
D. Maintain and repair walks, parking areas, and campsites.		
E. Maintain camp swimming pool.		
F. Perform first-aid, CPR, organize search parties, etc.		
G. Fight fires.		
H. Mow grass.		
I. Repair camp equipment.		
J. Lay out camp trails.		
K. Control insects, pests and woods.		
2. Developing winter recreation areas.		
A. Lay out ski trails.		
B. Maintain trails and snow.		

	Can Perform	Cannot Perform
C. Operate ski lift.		
D. Maintain lift.		
E. Patrol slopes.		
F. Mark and clear sled and toboggan trails.		
G. Develop rest areas.		
H. Rent equipment.		
I. Locate snowmobile tracks.		
J. Develop skating areas.		
K. Maintain ice.		
3. Operating vacation farms and riding stables.		
A. Repair buildings.		
B. Build fence.		
C. Groom horses.		
D. Train horses.		
E. Care for tack.		
F. Schedule activities for visitors.		
G. Mow grass.		
H. Feed horses.		
I. Mark and clear riding trails.		
V. Wildlife		
1. Identifying and managing wildlife		
A. Identify upland, waterfowl and protected bird species.		
B. Identify game, fur, protected and nuisance animal species.		
C. Plant cover and food crops.		
D. Construct nesting areas.		
E. Trap and re-release animals.		
F. Tag and band birds and animals.		
G. Install fences and signs.		
H. Operate and maintain farm and wildlife equipment.		
2. Determining wildlife populations		
A. Take true census.		
B. Estimate populations from sampling, indices, recapture or hunting methods.		

	Can Perform	Cannot Perform
C. Operate radio-tracking instruments.		
D. Mark birds and animals by color, mutilation or tagging.		
E. Take field notes.		
F. Evaluate food supply by clipping method or stems and seeds per sample acre.		
G. Evaluate cover density using photographic, visual and stems per sample acre methods.		
3. Propagating game birds.		
A. Incubate gamebird eggs.		
B. Control ventilation and temperature in breeding and growing houses.		
C. Feed birds of various stages of growth.		
D. Water birds.		
E. Maintain brooding houses.		
F. Manage brooder.		
G. Identify common contagious and non-contagious diseases.		
H. Identify and control internal and external parasites.		
I. Disinfect buildings and equipment.		
J. Clean brooding and growing houses.		
K. Determine when birds are ready for release.		
L. Catch birds.		
M. Cage and prepare birds for shipment.		
VI. Soils		
1. Surveying land		
A. Develop survey work plans.		
B. Determine distance by use of stadia, pacing, chaining and taping.		
C. Determine land slope with hand level.		
D. Establish turning points.		
E. Run bench level circuit.		
F. Run profile.		
G. Set slope stakes.		
H. Take backsight and foresight.		

	Can Perform	Cannot Perform
2. Mapping soils		
A. Interpret aerial photographs.		
B. Identify soil boundaries.		
C. Identify slope boundaries.		
D. Identify land use boundaries.		
E. Draw layout from field notes.		
F. Identify soil horizons.		
G. Classify soil according to texture, structure and color.		
H. Determine pH level.		
I. Classify soil water.		
J. Determine soil water holding capacity.		
3. Testing soil		
A. Take soil sample.		
B. Interpret soil test report.		
C. Take tissue tests.		
D. Interpret tissue tests.		
E. Use portable soil test kits.		
4. Planning and constructing drainage systems		
A. Lay out (stake) various drainage systems in field.		
B. Lay out water gates.		
C. Stake out pond.		
5. Planning Erosion Control Structures.		
A. Identify types of erosion.		
B. Locate waterways.		
C. Locate diversion ditches and open channels.		
D. Lay out contours.		
E. Recommend vegetation for erosion control structures.		
6. Performing general office work		
A. File.		
B. Use telephone.		
C. Write letters, memos and notes.		
D. Set-up educational displays.		
E. Prepare news releases.		
F. Serve as tour guide.		

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AGRICULTURAL MACHINERY SKILLS INVENTORY

Instructions to the student: Rate yourself on each of the "hands-on" skills listed below. These competencies have been identified as necessary to effectively teach an agricultural machinery program. When completed, make an appointment with your advisor to discuss this inventory and to obtain his recommendation for further experience if needed.

Instructions to the advisor: Discuss this inventory with the student when it has been completed. Recommend additional experience if it is needed.

Note: This inventory is used for the purposes of advisement only. It does not become part of the student's Career Placement File and cannot be used by the student or advisor for job placement.

	Can Perform	Cannot Perform
I. Parts		
1. Selling parts and other merchandise		
A. Use catalogs, price lists, and manuals and microfiche readers.		
B. Complete over-counter and telephone sales transactions.		
C. Set-up displays.		
D. Use credit and warranty plans.		
2. Inventorying and controlling parts		
A. Use hand or computer inventory system.		
3. Receiving parts		
A. Tag and bin parts.		
B. Process shortages, loss or damage claims.		
4. Ordering and returning parts		
A. Submit orders for breakdown or emergency repairs.		
B. Prepare monthly parts order.		
C. Use computer parts system with regional office.		
II. Set-up and Delivery		
1. Assembling equipment		
A. Set up equipment according to procedure.		
B. Check equipment for proper operation and make adjustments.		
C. Conduct pre-delivery service of equipment.		
2. Picking-up and delivering equipment		
A. Load and unload equipment properly.		
B. Describe general maintenance and operation procedures to customers.		
C. Complete delivery reports.		
D. Operate trucks.		
III. Service		
1. Diagnosing problems		
A. Troubleshoot tractor engine and component systems.		
2. Performing general maintenance work		
A. Change oil and filters.		
B. Service air cleaner.		

		Can Perform	Cannot Perform
	C. Adjust carburetors.		
	D. Adjust clutch pedal free travel.		
	E. Grease and oil equipment.		
	F. Service tires and tracks.		
	G. Adjust belts and chains.		
	H. Service battery.		
	I. Repack bearings.		
	J. Replace bearings and seals.		
	K. Service spark plugs and plug wires.		
	L. Service fuel strainers, filters and sediment bowl.		
	M. Purge air from diesel fuel system.		
3.	Repairing and maintaining brakes		
	A. Adjust mechanical and power brakes.		
	B. Replace lining, springs and pins.		
	C. Install shoes.		
4.	Repairing and maintaining wheels, tires and tracks		
	A. Adjust track tension.		
	B. Patch tubes.		
	C. Inspect or replace bearings and seals.		
	D. Install track.		
	E. Load tires with liquid.		
5.	Repairing and maintaining the steering system		
	A. Bleed power steering system.		
	B. Adjust toe-in, drag link and turning angle.		
	C. Install ball joints and tie rods.		
	D. Replace bearings, gears and knuckles.		
	E. Install power steering motor and valve assembly.		
6.	Repairing and maintaining the air conditioning system		
	A. Discharge and charge system.		
	B. Install compressor, evaporator or expansion valve.		
7.	Repairing and maintaining the power train		
	A. Adjust gear and shaft end-play and backlash.		
	B. Adjust shift linkage.		

	Can Perform	Cannot Perform
C. Inspect or replace shafts, forks, disks and springs and gears.		
D. Drain, flush and refill transmission.		
E. Inspect or replace bearings and seals.		
F. Pre-load gear train.		
G. Inspect or replace electric or hydraulic clutch controls.		
H. Inspect or replace transmission oil pump.		
I. Replace transmission oil filter.		
J. Replace gaskets.		
8. Repairing and maintaining the hydraulic system		
A. Bleed hydraulic system or remote cylinders.		
B. Drain, clean, flush and refill hydraulic system.		
C. Add hydraulic fluid.		
D. Read schematic of hydraulic system.		
E. Troubleshoot hydraulic system.		
F. Install O-rings, seals packing, hoses and tubing.		
G. Install pump.		
H. Replace hydraulic oil filters.		
9. Repairing and maintaining the ignition, charging, starting system and electrical accessories		
A. Time engine.		
B. Repair starter.		
C. Replace points and plugs.		
D. Repair electrical wires.		
E. Install distributor regulator and generator.		
F. Replace wiring harness.		
G. Test coil, condensor, generator.		
H. Replace fuses, circuit breakers, gauges and switches.		
10. Overhauling and maintaining engines		
A. Adjust valve clearance.		
B. Deglaze cylinder.		
C. Grind valves.		
D. Install head and head gasket.		
E. Install valve guides, valve seats and valves.		

	Can Perform	Cannot Perform
F. Inspect bushings and bearings.		
G. Inspect and measure valve margins and seats.		
H. Inspect and measure rod and bearing tolerances.		
I. Inspect and measure cylinder bore.		
J. Inspect and measure piston and ring tolerance.		
K. Rebore cylinders.		
L. Remove and install camshaft.		
M. Remove and install crankshaft.		
N. Remove and install cylinder liners.		
O. Install front and rear oil seals.		
P. Install piston assembly.		
Q. Install rocker arm assembly.		
R. Replace timing chair or gears.		
S. Remove cylinder ridge.		
T. Replace bearings or bearing inserts.		
11. Repairing and maintaining governor systems		
A. Adjust governors.		
B. Remove and install governor or ventilator pump.		
C. Replace governor thrust bearings and weights.		
12. Repairing and maintaining oil lubrication systems		
A. Adjust oil pressure		
B. Clean oil cooler.		
C. Remove and install oil pump.		
D. Remove and install oil cooler.		
13. Repairing and maintaining the cooling system		
A. Backflush cooling system.		
B. Test system for leaks.		
C. Remove and install water pump.		
D. Pull and replace radiator.		
E. Replace radiator hoses, thermostats, seals and belts.		
F. Replace fan belt.		
14. Repairing and maintaining gas and diesel fuel systems		
A. Overhaul carburetor.		
B. Test, remove and install diesel fuel pump or gas fuel pump.		

		Can Perform	Cannot Perform
	C. Test and replace injection nozzles.		
	D. Replace fuel lines, filters and screens.		
	E. Run manifold vacuum test.		
	F. Time injection pump.		
15.	Preparing used (trade-in) equipment for sale		
	A. Clean equipment.		
	B. Prepare equipment for painting.		
	C. Operate spray paint gun.		